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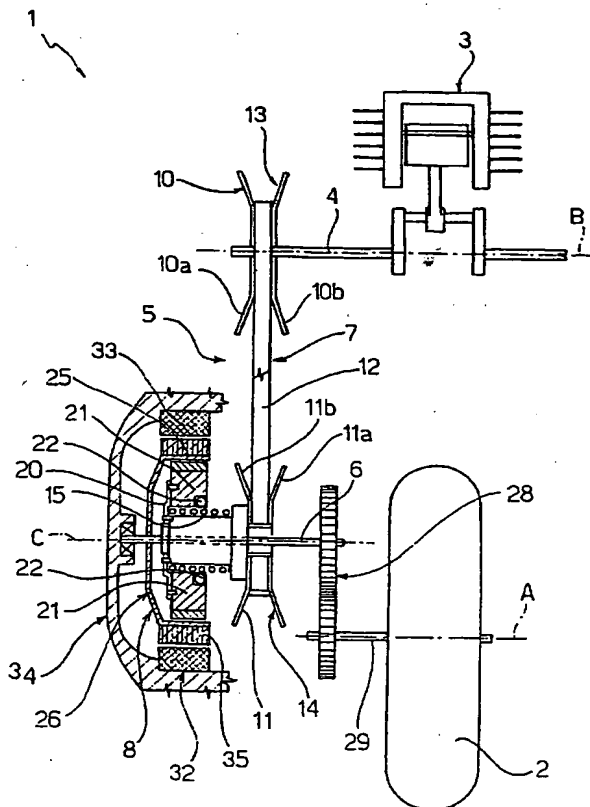
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[Continued on next page]

(54) Title: **HYBRID DRIVE ASSEMBLY FOR A VEHICLE, IN PARTICULAR A SCOOTER**



(57) Abstract: A hybrid drive assembly (1) for a vehicle having at least one drive wheel (2), the drive assembly including an internal combustion engine (3); a transmission unit (5) interposed between a drive shaft (4) of the internal combustion engine (3) and a propeller shaft (6) connected angularly to the drive wheel (2), and in turn including a continuously variable transmission (7) having a drive pulley (10) connected angularly to the drive shaft (4) and a driven pulley (11), and a centrifugal clutch (8) having a hub (20) connected to the driven pulley, and a driven bell (26) connected to the propeller shaft (6); and an electric machine (32) having a rotor (35) integral with the bell (26) of the centrifugal clutch (8). The drive assembly (1) is controlled by a control unit (38), in response to a number of input signals (Ss, Sa, Sf), in a number of operating modes including an all-combustion propulsion mode, an all-electric propulsion mode, a first hybrid propulsion mode wherein the internal combustion engine (3) and the electric machine (32) are connected in series, and a second hybrid propulsion mode wherein the internal combustion engine (3) and the electric machine (32) are connected in parallel.

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 908 343 A (AISIN AW CO) 14 April 1999 (1999-04-14)	1,4-7,9, 12-15
Y	paragraphs '0011!', '0014!', '0039!'; figure 1	3,10,11
X	DE 100 36 966 A (TOYOTA JLDOSHA KABUSHIKI KAISH) 5 April 2001 (2001-04-05)	1,2,5-7, 10-15
Y	column 4, line 5 -column 5, line 25; figures 1-3	3
X	US 2001/024994 A1 (SUGANO TAKU) 27 September 2001 (2001-09-27)	1,2,5
Y	paragraphs '0022!', '0041!'; figure 1	3
Y	US 5 841 201 A (IBARAKI RYUJI ET AL) 24 November 1998 (1998-11-24)	10,11
	abstract; figure 1	
	-/-	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 445 873 A (PIAGGIO VEICOLI EUROP) 11 September 1991 (1991-09-11)	1,2
Y	claim 5; figure 1	3
X	DE 100 06 743 A (STROBEL MARTIN) 12 October 2000 (2000-10-12) column 2, line 40 -column 2, line 65; figure 1	1,2
X	US 6 155 366 A (LIN YU TSAI) 5 December 2000 (2000-12-05) column 2; figure 3	1,2

## INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report		Publication date		Patent family member(s)	Publication date
EP 0908343	A	14-04-1999	JP	11107798 A	20-04-1999
			EP	0908343 A2	14-04-1999
			US	6269895 B1	07-08-2001
DE 10036966	A	05-04-2001	JP	2001047881 A	20-02-2001
			DE	10036966 A1	05-04-2001
			US	6344008 B1	05-02-2002
US 2001024994	A1	27-09-2001	JP	2001260674 A	26-09-2001
US 5841201	A	24-11-1998	JP	9233607 A	05-09-1997
			JP	3097559 B2	10-10-2000
			JP	9317515 A	09-12-1997
EP 0445873	A	11-09-1991	IT	1239368 B	20-10-1993
			AT	93455 T	15-09-1993
			DE	69100291 D1	30-09-1993
			DE	69100291 T2	24-02-1994
			EP	0445873 A1	11-09-1991
			ES	2043424 T3	16-12-1993
			JP	4218430 A	10-08-1992
			US	5193634 A	16-03-1993
DE 10006743	A	12-10-2000	DE	10006743 A1	12-10-2000
US 6155366	A	05-12-2000	NONE		